The use of biometric technologies for weapon system security

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Introduction

- Increasing weapons power and portability
- Unauthorised usage ideally avoided
- Fingerprinting technology provides a method for making systems secure

Fingerprinting - Advantages

- Compact
- Quick
- Simple operation
- Uses already proven technology
- Not without problems!

Hitachi Digital Fingerprint sensor

Kinetic Sciences Inc Vancouver

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Fingerprinting - Problems

- A process of comparison of ridges
- Ridge pattern duplication
- Severed limbs
- Techniques exist to prevent this
  - e.g. temperature, conductivity
  - All can be bypassed

www.dansdata.com

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Finger Anatomy

- Various bio-materials present
- Differing mechanical properties
- Gives the fingertip non linear viscoelastic properties
  - Force dependant
  - Rate dependant
  - History dependant

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Fingertip Deformation Modelling

- Deformation amount controls fingerprint size
- Fingertip modelled as a homogeneous material
- Use finger size and force applied to predict fingertip deformation
- Force can be measured, leaving finger size for differing between individuals

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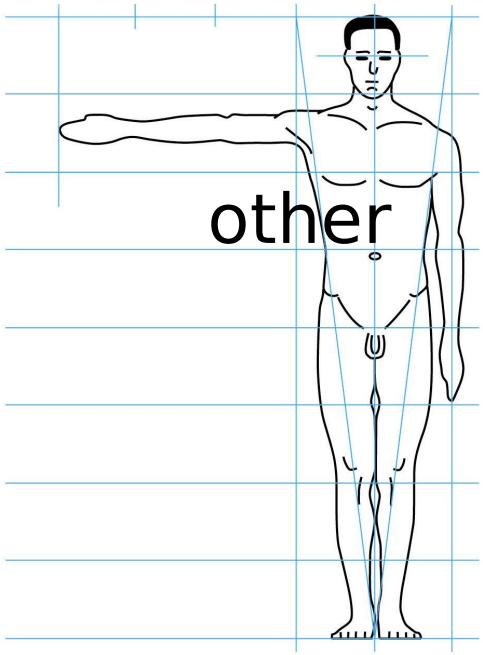
Body Proportion

- Been used for centuries by artists
- Recent surveys have shown strong correlations (Roebuck, 1995)
- Is fingertip size correlated with other body characteristics?
  - Height
  - Weight
  - Limb lengths



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Anthropometry survey

- Aim
  - Investigating correlations between hand size and whole body characteristics

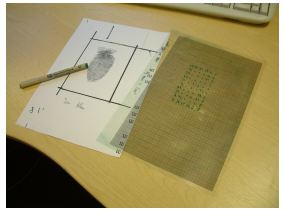
- Format
  - 70 male participants
  - 14 hand measurements
  - Stature and weight measurement

Anthropometry Survey

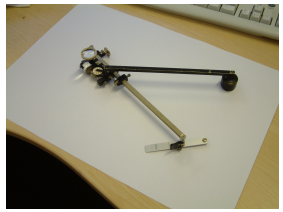
- Results
  - Pearson correlations produced for all measurement pairings
  - Hand length highly correlated to arm length
  - Arm length highly correlated to height
  - Wrist circumference highly correlated to weight
- Conclusions
  - Body proportionality does include the hand
  - More detailed measurements of the hand must be performed

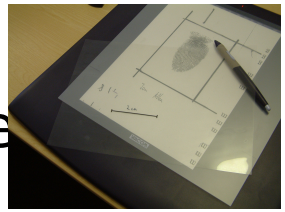
Practical Application

- A reliable area measurement technique is needed

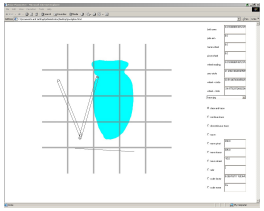


- Tests of laboratory based techniques
  - Problems found due to variations in ink deposited
  - Similar problems with oil, dirt, moisture etc
  - Physiological variables also require conside





- These must be accounted for in any practical application of this idea



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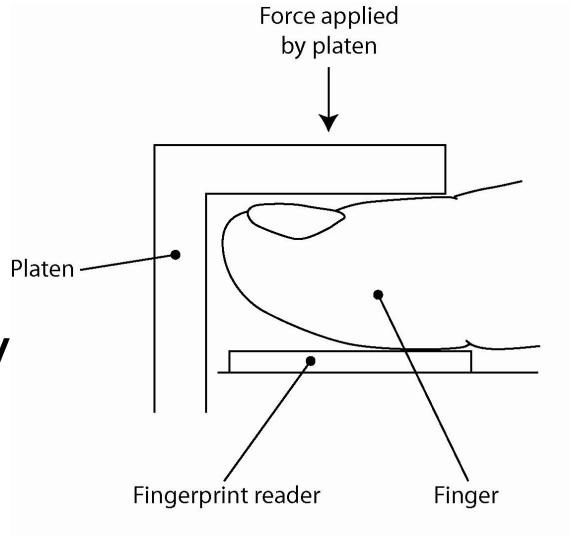
Application – Concept 1

- Fingerprint scanner combined with a force applying platen



- Advantages
  - Simple design
  - Uses much existing technology
- Disadvantages
  - Platen will add bulk to the device
  - Possible discomfort due to pressure on fingernail

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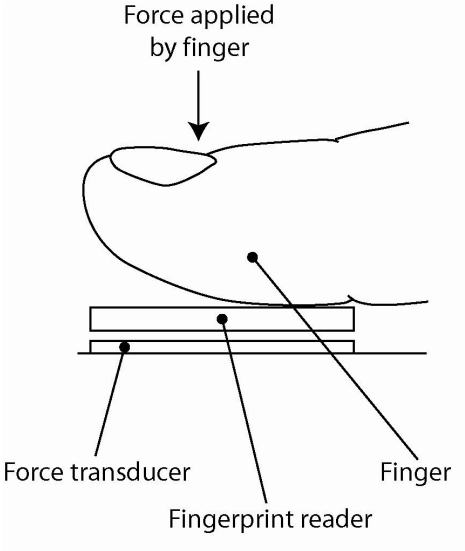
Application – Concept 2

- Fingerprint scanner combined with a force sensor

- Advantages
  - Compact
  - Operated in the same manner as existing fingerprint sensors
  - Uses much existing technology



- Disadvantages
  - An accurate model of fingertip deformation required

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Application – Concept 3

- Concept 2 combined with body size prediction
- Advantages
  - Most secure
  - Uses much existing technology
- Disadvantages
  - Most complex
  - Extra sensor required for predicted body dimension
  - Limited applications

Summary

- Current fingerprinting security is not infallible
- Fingertip deformation influences Fingerprint area
- Fingertip deformation is predicable
- The human body is proportional in scale
- No current model predicting fingerprint area

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Future Work

- A method for augmenting fingerprint recognition
- Collection of anatomical and physiological data to aid the development of a predictive model of the fingertip
- Integration of fingertip model into biometric systems

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